

# *Laser Principle*

## CHAPTER (1) INTRODUCTION TO LASER (Historical Viewing).

1. Innovations .
2. Emission .
3. Appearance of a Maser .
4. Laser generator .
5. Properties of Laser light .

## CHAPTER (2) OPERATION OF A LASER PRINCIPLE

1. Emission & Absorption of light .
2. Population inversion .
3. Energy pumping .
  - 3-Level system .
  - 4-Level system .

## **CHAPTER (3) OPTICAL CAVITIES (resonators) (cavity configurations)**

1. Transverse Electromagnetic Modes (TEM) .
2. The plane-parallel cavity .
3. The large-radius cavity .
4. The confocal cavity .
5. The concentric cavity .
6. The hemispherical cavity .
7. The long-radius hemispherical cavity .

## CHAPTER (4) SPECTROSCOPE OF THE LASER LIGHT

1. Line width ( $\Delta\nu$ ) PROPERTIES,
2. *Line broadening.*
  - Homogeneous broadening (collision broadening & radiation broadening) .

- In Homogeneous broadening (Doppler broadening & Impurities broadening).

3- Longitudinal Laser mode .

4- Longitudinal mode selection methods.

## **CHAPTER (5) HIGH POWER TECHNIQUES**

*1-Q-Switching (mechanical ,chemical ,electro-optic)methods.*

2-Mode locking .(active & passive) methods.

## **CHAPTER(6)SOLID STATE LASER**

1. Energy levels for impurity ions in solid materials .

2. Frenal .

3. Ruby Laser .

4. Nd-YAG Laser .

5. Nd-Glass Laser .

6. Alexandrite Laser( $\text{Cr}^{+3}$ :  $\text{BeAl}_2\text{O}_2$  Laser) .

7. Color-center powder Laser .

## **CHAPTER (7) SEMICONDUCTOR LASER**

1. Interinsic & Impurities of Semiconductor.

2. P-N Junction .

3. Direct Transfer Laser .

4. Indirect Transfer Laser .

5. Optical- Magnetic Laser .

6. P-N Junction Laser

## **CHAPTER (8) GAS LASERS**

1. Atomic gas Lasers (Cu-vapour ,He-Ne) Laser.

2. Ionic gas Lasers (Cd-He , Arogon ion) Laser.

3. Molecular gas Laser ( $\text{CO}_2$  ,  $\text{N}_2$  ,Excimer ,chemical and Far Infrared (FIR)) Laser.

## **CHAPTER (9) LIQUID DYE LASERS**

1. Physical properties of dye Laser .
2. Energy Transfers in dye molecules .
3. Energy pumping in dye Laser .
4. Examples .